Optical and dielectric studies for Tb^{3+}/Sm^{3+} co-doped borate glasses for solid-state lighting applications

ABSTRACT

Singly doped Tb3+ and Sm3+ ions along with co-doped Tb3+/Sm3+ borate glasses have been fabricated by melt quenching technique. Both TGA and DSC curves were measured for exploration of thermal properties. Among all Tb3+/Sm3+ co-doped glasses, the (Tb0.5-Sm0.5) glass shows the highest emission intensity with respect to others. A total of five emission bands where two are from Tb3+ transitions corresponding to 488 nm (blue) (5D4 → 7F6) and 543 nm (green) (5D4 → 7F5) are found. Three emission bands from Sm3+ at 563 nm (green), 599 nm (orange-red) and 645 nm (red) according to 4G5/2 → 6H5/2, 4G5/2 → 6H7/2, and 4G5/2 → 6H9/2 electronic transitions are identified. The calculated CIE chromaticity (x,y) coordinates for singly doped Tb3+ (Tb0.5) green emission, singly doped Sm3+ (Sm0.5) orange-red emission, and co-doped Tb3+/Sm3+ (Tb0.5-Sm0.5) yellow emission are (0.343, 0.584), (0.607, 0.389), and (0.438, 0.515), respectively, following the CIE 1931 chromaticity diagram. Further, dielectric features were studied for the Tb3+/Sm3+co-doped glass (Tb0.5-Sm0.5) in terms of dielectric constant, dielectric loss and AC conductivity with the increasing of frequency and temperature.

Keyword: Borate glass; Thermal analysis; Luminescence property; Dielectric property